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METEOROLOGY.—*Solar radiation intensities at Madison, Wis.* H. H. KIMBALL and E. R. MILLER. To appear in full in the Bulletin of the Mount Weather Observatory.

Since July 19, 1912, measurements of the intensity of the solar radiation received upon a surface normal to the direction of the incident solar rays have been made at the Weather Bureau office, Madison, Wis., on days when the sky was free from clouds.

A Marvin pyrheliometer, standardized by comparison with a Smithsonian silver disk pyrheliometer, has been employed in making the measurements. A brief description of this pyrheliometer will be found in the *Bulletin of the Mount Weather Observatory*, volume 3, page 81. The instrument has been exposed on shelves outside the office windows at an elevation of 974 feet above sea level. The latitude of Madison is 43° 05′ north.

The monthly means of a.m. and p.m. measurements are given in table I, each mean being the average of measurements obtained on not less than three different days.

The monthly means of a.m. and p.m. measurements made at Washington, D. C., with an Angstrom pyrheliometer, have been published in the *Bulletin of the Mount Weather Observatory*, volume 3: pages 86 to 91, inclusive. To facilitate comparison, these have been reduced to the Smithsonian standard by dividing by the factor 0.95, and the results are given in table II.

It will be seen from these tables that while the monthly averages of radiation intensities for Washington and Madison differ

but little during the warm months of the year, or from May to October, inclusive, the excess of the averages for Madison over those for Washington during the cold months is pronounced.

This excess cannot be attributed to a difference in the vapor content of the atmosphere at the two stations. The average difference in their respective water vapor pressures in winter does not exceed two millimeters, and as has been shown by one of us,[1] this would account for a difference in radiation intensities of only

TABLE I

MONTHLY MEANS OF SOLAR RADIATION INTENSITY AT MADISON, WIS., FOR THE TWO YEARS JULY, 1910, TO JUNE, 1912, INCLUSIVE, EXPRESSED IN GRAM-CALORIES PER MINUTE PER SQUARE CENTIMETER OF NORMAL SURFACE.

MONTH		AIR MASS								
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
January	a.m.			1.44	1.44	1.34			1.12	
	p.m.				1.42	1.33	1.24			
February	a.m.		1.56	1.49	1.42	1.39	1.26	1.18	1.08	1.15
	p.m.			1.51	1.45	1.38	1.26			
March	a.m.		1.48	1.40	1.33	1.26	1.17	1.09	1.06	
	p.m.		1.44	1.38	1.29	1.22				
April	a.m.		1.38	1.30	1.21	1.18	1.10			
	p.m.		1.40	1.31	1.19	1.11				
May	a.m.	1.36	1.21	1.08	0.97					
	p.m.		1.16							
June	a.m.	1.26	1.19	1.11						
	p.m.									
July	a.m.	1.25	1.18	1.08	0.93					
	p.m.									
August	a.m.	1.33	1.22	1.14	1.07	0.96	0.93	0.86		
	p.m.		1.12	0.99	0.82	0.72				
September	a.m.		1.23	1.10	1.03	0.96	0.89	0.86		
	p.m.		1.24	1.10	1.04	0.95	0.83	0.76	0.74	
October	a.m.		1.28	1.17	1.10	1.03	0.92	0.90	0.73	
	p.m.			1.21	1.16	1.08				
November	a.m.			1.36	1.30	1.26	1.21	1.15	1.05	
	p.m.				1.31	1.27				
December	a.m.				1.31	1.21	1.15	1.13		
	p.m.					1.25				

NOTE:—The air mass is approximately the secant of the sun's zenith distance.

[1] Jour. Franklin Inst., 171: 339. April, 1911.

about 0.02 calories when the sun is at zenith distance 60°, and the air mass = 2.

The excess can only be attributed in part to difference in atmospheric pressure at the two stations, since their respective averages, 29 inches of the barometer at Madison and 30 inches at Washington, would account for a difference of only about 1 per cent in the atmospheric transmission coefficients for the two stations, or to a difference of about 0.05 or 0.06 calories in the radiation intensities when the air mass = 2.

TABLE II

MONTHLY MEANS OF SOLAR RADIATION INTENSITIES AT WASHINGTON, D. C., FOR THE FIVE YEARS MAY, 1905, TO APRIL, 1910, INCLUSIVE, EXPRESSED IN GRAM-CALORIES PER MINUTE PER SQUARE CENTIMETER OF NORMAL SURFACE.

MONTH		AIR MASS								
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
January	a.m.			1.20	1.05	1.05				
	p.m.			1.24	1.12	1.04	0.94	0.88	0.83	0.76
February	a.m.			1.29	1.16	1.10				
	p.m.		1.38	1.23	1.12	1.01	0.95	0.93	0.83	
March	a.m.		1.20							
	p.m.		1.32	1.14	1.04	1.01	0.91	0.82		
April	a.m.	1.41	1.19	1.08	1.02	1.00				
	p.m.	1.39	1.20	1.05	0.95	0.88				
May	a.m.	1.41	1.17	1.13	0.99					
	p.m.	1.26	1.16	1.01	0.87					
June	a.m.									
	p.m.	1.26	1.08	1.06	0.99	0.88				
July	a.m.	1.35	1.21	1.15	1.03	0.95				
	p.m.		1.01	0.90						
August	a.m.	1.24	1.08							
	p.m.		1.04	0.95						
September	a.m.		1.30	1.19	1.05	0.95				
	p.m.		1.19	1.05	1.01	0.95	0.85			
October	a.m.		1.26	1.15	1.06	0.93				
	p.m.		1.23	1.14	1.03	0.93	0.84	0.81	0.74	0.65
November	a.m.		1.44	1.29	1.20	1.11	0.91			
	p.m.		1.45	1.22	1.11	1.02	0.92	0.84	0.82	0.79
December	a.m.			1.21	1.15	1.07	1.01	0.97		
	p.m.			1.24	1.14	1.05	0.97	0.89	0.88	0.77

NOTE:—The air mass is approximately the secant of the sun's zenith distance.

These two causes combined therefore account for less than one-half the difference between the radiation intensities measured at Madison and Washington in winter.

There remains to be considered the relative effect of the dust content of the atmosphere at the two stations, with respect to which no data are available. These pyrheliometric measurements lead to the conclusion, however, that on clear days in winter, when the northern part of the United States is generally covered with snow, the atmosphere at Madison contains much less dust than the atmosphere of Washington, a difference that does not exist during the summer months.

ELECTRICITY.—*Constancy of wire resistance standards.* FRANK WENNER, Bureau of Standards. Communicated by E. B. Rosa.

On account of the convenience and of the high sensitivity readily attainable, electrical methods are being used more and more in various kinds of physical measurements. The numerical values obtained then are in terms of electrical units and the reliability of the results depends on the reliability of the electrical standards used.

In most of the more precise measurements of energy or heat and power as well as in primary electrical measurements with mercury resistance standards and the silver voltameter, and in absolute measurements of resistance and current the results obtained usually involve the resistance of one or more wire resistance standards. In all such and many other measurements the reliability of the results depends upon the constancy, over a longer or shorter time, of the resistance standards used.

It is therefore highly desirable that our standards should be so constructed as to have as nearly a constant resistance as it is possible to obtain, and that the small changes taking place be known as definitely as it is possible to obtain them.

At the Bureau of Standards ten 1-ohm resistance standards of the sealed type[1] in which the resistance material is manganin, were selected for use as a reference set. Whenever the resistance

[1] Rosa, Bull. Bureau Standards. 4: 413. 1908.

of one of these standards changes appreciably it is replaced by another whose resistance is known to be more constant. In March, 1909, values were assigned to the standards of the reference set, and since that time it has been assumed that their mean value has remained constant. The values assigned to all the standards belonging to the Bureau and to the standards submitted for test all involve this supposition. In May, 1910, certain standards from the national laboratories of England, Germany, France and the United States were compared, and considering all the data available the most probable value in International Ohms was assigned to the various standards. This resulted in an addition of 7 parts per million to the mean value of the reference set. Values obtained from measurements made before May, 1910, have had this correction applied so that all are on the same basis. That is, all values are based on the supposition that the mean value of the ten 1-ohm standards constituting the reference set has remained constant since March, 1909.

Values on different dates and at a temperature of 25° C. of a number of 1-ohm standards of the sealed type are given in table I. Here the identification number of the standard is given

TABLE I

1-OHM STANDARDS—SEALED TYPE

Excess of resistance above one ohm, on different dates at 25°C, and change in 2½ years in millionths of an ohm

NUMBER	MARCH, 1909	OCTOBER, 1909	MARCH, 1910	AUGUST, 1910	MARCH, 1911	JANUARY, 1912	CHANGE IN 2½ YEARS
3	53	56	59	61	63	66	+13
4		31	32	30	31	29	− 2
7	61	62	63	64	65	65	+ 4
8	69	69	69	69	69	69	0
11		63	61	54	53	53	−10
12		61	59	57	54	54	− 7
13	90	92	95		106	106	+16
19	127	144	153	158	163	165	+38
3939	97	96	98	99	99	97	0
3940	98	95	96	98	99	98	0

This table shows that during 2½ years the resistance of only one of these standards changed by more than 0.002 per cent and that the average change was less than 0.001 per cent.

in the first column and the amount in parts per million by which its resistance exceeded its nominal value is given in the succeeding columns. It will be observed that for most of the standards the values on different dates are very nearly the same. As most of these standards belong to the reference set we cannot assume that these figures give anything more than the relative constancy of a number of standards selected because of their small changes as compared with each other.

With the older or Reichsanstalt type of standards the relative changes were usually considerably more, especially in standards having resistances of 1000 ohms or above, where the changes in two or three years have sometimes amounted to 0.1 per cent or even more. When, however, the standards of the higher denomination are of the sealed type the changes are much smaller. The values of all the 10,000-ohm standards of the sealed type belonging to the Bureau of Standards are given in table II and it will be

TABLE II

10,000-OHM STANDARDS—SEALED TYPE

Excess in resistance above nominal value, on different dates at 25° C., and change in 2½ years in parts per million

NUMBER	FEBRUARY, 1909	JULY, 1909	FEBRUARY, 1910	MAY, 1910	APRIL, 1911	JANUARY, 1912	CHANGE IN 2½ YEARS
1		−142	−124	−128	−118	−124	+18
2		− 63	− 50	− 59	− 36	− 55	+ 8
3		131	136	131	134	134	+ 3
4	177	178	182	174	177	174	− 4
5	161	161	145	138	142	144	−17
6		145	154	147	152	149	+ 4
7		133	158	156	182	186	+53
3931		143	163	159	172	151	+ 8
3932		117	111	103	112	99	−18

This table shows that during 2½ years only one of the standards changed in resistance by as much as 0.005 per cent.

observed that the resistance of only one of the nine changed in comparison with the reference set by more than 20 parts per million during two and one-half years. The actual changes as compared with the reference set may be somewhat more or somewhat

less than that indicated by the table since the error in comparing a 10,000-ohm standard with a 1-ohm standard, as formerly made, may have amounted to several parts per million.

To what extent the mean value of the reference set has remained constant and may be expected to remain constant, or the mean value of any other reference set may be expected to remain constant, is a matter of prime importance. The history of a standard or set of standards giving the resistances on different dates should in most cases indicate the further changes to be expected.

The standards constituting the reference set were made at different times, by different persons using wire made under different conditions. Therefore, when we find their relative values and their mean values as compared with a large number of standards of different denominations remaining remarkably constant, it is reasonable to suppose that their mean value is also remaining very constant. This supposition, however, is not entirely justifiable since the resistance of most of the standards may conceivably be changing at an approximately uniform rate, and if so the intercomparisons made between the various standards furnish no means of detecting such a change. We are therefore desirous of knowing more about the constancy of the mean value of the reference set than can be obtained by comparing standards, in all of which the resistance material is manganin. It is therefore desirable to construct additional standards using other resistance materials. If two or three sets of standards each of a different resistance material are found to remain relatively constant, then there is much more justification for assuming the mean value of a selected set of standards as constant.

In this a beginning has been made in that a few standards in which the resistance material is the new alloy "therlo" have been under observation for more than a year.

The alloy is one of a number developed by Wilbur B. Driver and has many advantages for use as a resistance material in standards and various kinds of resistance apparatus. The indications are that standards in which it is used will be found fully as reliable as those in which manganin is used. In such standards the resistance increases for a few months following the annealing but

seems to become very constant within a year. Where manganin is used a very similar increase in resistance takes place while the standard is new. In order to make further test of the material and to determine what the heat treatment should be, coils have recently been constructed of hard-drawn wire and of wire annealed before insulating and these have been annealed at different temperatures after winding.

As a further means of determining the changes in the mean values of the standards of the reference set, certain standards have been sent abroad and measured at the national laboratories of England, Germany and France. Since May, 1910, a number of measurements have been made of the resistance of seven different standards. The 23 values assigned were usually each the mean of the values found by a number of different measurements. As compared with the values assigned to the same standards in the Bureau of Standards the mean difference, taken without regard to sign, is less than one part in one hundred thousand. This shows that the unit used in each of the laboratories continues to be very nearly the same.

Ultimately we depend for our unit of resistance on an arbitrary standard such as the mercury ohm or on an absolute measurement of some particular resistance.

Mercury resistance standards are sufficiently reproducible so that different laboratories agree to within two or three parts in a hundred thousand. Absolute measurements have not as yet been made as close as this. Wire standards are now so constant that a reference to mercury ohms need be made much less often than formerly, and international uniformity is maintained chiefly by the use of wire standards.

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. Each of the scientific bureaus in Washington has a representative authorized to forward such material to this journal and abstracts of official publications should be transmitted through the representative of the bureau in which they originate. The abstracts should conform in length and general style to those appearing in this issue.

ELECTRICITY.—*A tubular electrodynamometer for heavy currents.* P. G. AGNEW. Bulletin Bureau of Standards, **8**: — 1912.

The field "coil" of the instrument consists of two coaxial copper tubes, thus giving a circular magnetic field in the space between the tubes. On direct current the distribution of the current is assumed to be uniform over the cross section of the tubes, but on alternating current, as is well known, the current is crowded toward the outside of the inside tube and toward the inside of the outside tube, and the amount of this change of distribution depends upon the frequency. But if we have axial symmetry the magnetic field at any point is independent of the current distribution. For there is no magnetic field between the tubes due to the outside tube, and the field at any point due to the current in the inside tube symmetrically distributed about the axis depends only on the distance of the point from the axis, and therefore the total effect is independent of the distribution of current, so long as it is symmetrical with respect to the axis.

There are two moving coils astatically placed between the tubes, one above and one below the inner tube, and suspended by a phosphor bronze strip. The common axis of the tubes is placed in a horizontal position in order to permit the use of a vertical suspension. While the distribution of the current is not the same on alternating as on direct current, the magnetic field in the space between the tubes and hence the torque is the same.

With water passing thru the inner tube, the instrument will carry continuously 5000 amperes, and without water cooling, 1200 amperes. The current-carrying capacity of the moving coils is 0.06 ampere.

Difficulties were at first encountered, due to distortion of the inside tube by differential thermal expansion, and by magnetic impurities in the moving coil, but these were finally overcome.

It is of first importance to determine whether the instrument is affected by residual distribution errors. It has been found that a purely electrical test can be used for the exact centering of the inside tube, so that any such residual errors due to imperfections of workmanship can be removed.

At commerical frequencies no error whatever could be detected, due to eddy currents being set up in the tubes by the current in the moving coils.

Measurements of large currents by means of a current transformer whose ratio had been carefully determined were in substantial agreement with the indications of the tubular dynamometer. It is believed that the instrument is accurate to 0.05 per cent. P. G. A.

ELECTRICITY.—*The testing and properties of electric condensers.* Circular Bureau of Standards, no. 36. 1912.

In the testing of condensers over a period of years, much information has been collected, only a part of which is at present available to the public. Also, a large amount of work has been done elsewhere, which has appeared in various publications. It is the purpose of this circular to collect together the important facts concerning condensers and to present them as a connected whole. The different kinds of condensers are described and their properties discussed, and the most satisfactory methods of testing indicated. H. L. CURTIS.

CHEMISTRY.—*The standardization of potassium permanganate solution by sodium oxalate.* R. S. MCBRIDE. Bulletin Bureau of Standard, **8**: 612–643. 1912.

It was desired to determine the effect of the variation of the following factors upon the result obtained in the standardization of potassium permanganate by sodium oxalate, viz: temperature, acidity, volume of solution, rate of addition of the permanganate, access of air, presence of added manganous sulfate, and in connection with these, the corrections necessary upon the apparent end-points. In order to accomplish such determination the factors were varied one at a time and the effect, if any, produced upon the apparent value of the permanganate noted. Each of the factors was found to have a definite, though small, influence upon the result.

The effects were undoubtedly due to a variation of the reaction from the normal course as usually given. Such variations might tend to cause the use of an excess of either permanganate or oxalate; or both

sorts of influence might operate at the same time, in equal or unequal degree. The nine possible sources of variation are: (a) loss of oxalic acid by volatilization, (b) decomposition of oxalic acid by water, (c) decomposition of oxalic acid by sulfuric acid, (d) oxidation of oxalic acid by the air, (e) incomplete oxidation of the oxalic acid, (f) liberation of oxygen during the reaction, (g) incomplete reduction of the permanganate to the manganous state, (h) presence of impurities in the oxalate of either greater or less reducing power, and (i) formation of other products of the oxidation than carbon dioxide and water. Of these only two appeared to be at all probable, viz: loss of oxygen and atmospheric oxidation of the oxalic acid, and furthermore, only the first of these two could be held in the light of all the experiments reported.

If the main source of error is due to an oxygen loss the higher values obtained in the various series must be taken as correct. On this basis the following method of titration is recommended: in a 400 cc. beaker dissolve 0.25 to 0.3 gram of sodium oxalate in 200 to 250 cc. of hot water (80 to 90°) and add 10 cc. of 1:1 sulfuric acid. Titrate at once with $\frac{N}{10}$ $KMnO_4$ solution, *stirring the liquid vigorously and continuously.* The permanganate must not be added more rapidly than 10 to 15 cc. per minute and the last 0.5 to 1 cc. must be added dropwise with particular care to allow each drop to be wholly decolorized before the next is added. The solution should not be below 60° by the time the end-point is reached The excess of permanganate used to cause the end-point color must be estimated by matching the color in another beaker containing the same bulk of acid and hot water.

Under the above condition the agreement of duplicates should be at least 1 part in 2000; and the variation from absolute accuracy of average values is probably not greater than 0.05 per cent. Under other conditions than those described it is possible to obtain correct results; but by using the procedure recommended the difficulties of the titration are reduced to a minimum. R. S. M.

GEOLOGY.—*The earthquakes at Yakutat Bay, Alaska, in September, 1899.* RALPH S. TARR and LAWRENCE MARTIN. Professional Paper U. S. Geological Survey No. 69. 1912. Pp. 135, with maps, views, and sections.

In September, 1899, the region around Yakutat, Alaska, was shaken by a series of severe earthquakes, attended by great changes in the level of the land and remarkable changes in the adjacent glaciers.

The changes of level are the greatest recorded in historical times, the

maximum uplift amounting to over 47 feet. The changes in the glaciers include a rapid retreat of Muir Glacier, 150 miles to the southeast, and a general advance of several glaciers near Yakutat Bay. Muir Glacier, which hundreds of travelers had visited annually up to 1899, became inaccessible to tourist vessels in that year and remained so till 1907. By 1903 it had retreated from 2½ to 3 miles, and by 1907 from 7½ to 8 miles, perhaps in part as an indirect result of this earthquake, and had lost much of its scenic interest. The advance of the glaciers near Yakutat Bay included the eastern or Marvine lobe of the great Malaspina Glacier and rendered that highway of glacier travel inaccessible thru intricate crevassing.

The shocks lasted twenty-seven days—September 3 to 29, 1899—and included four or five world-shaking disturbances and hundreds of minor shocks. During four weeks there was almost constant palpitation of this part of the earth's crust. The shocks were most severe on September 3, 10, and 23, and were great on the 15th, 17th, 26th, and 29th. On the 10th there were over fifty small shocks and two world-shaking disturbances. The greatest faulting took place on September 10.

The phenomena accompanying the shocks were observed at distances of 5 to 730 miles, and perhaps raised water waves on Lake Chelan, in Washington, over 1200 miles away. The minimum land area shaken was 216,300 square miles, the water area being as much more, while distant observations suggest that the shocks may have been sensible over 1,539,000 square miles. These earthquakes seem to have originated in or near Yakutat Bay, which lies close to the bend of the St. Elias Range, near latitude 140 degrees west and longitude 60 degrees north.

The physical changes brought about by the earthquakes are correlated with the growth of the St. Elias Range and evidence of older faulting, changes of level, and glacial oscillations are recognized. A. H. Brooks.

TOPOGRAPHY.—*Topology, topography and topometry.* Francois E. Matthes. Bulletin American Geographical Society, vol. xliv, May, 1912.

Topology, topography and topometry are three terms now current among French topographers, and used to denote three distinct though allied concepts. In this country no attempts have as yet been made to clearly differentiate these concepts, and the single term "topography" is still employed, more or less loosely and inaptly to designate different classes of work.

In the first place the French have learnt to appreciate the fundamental difference that exists between maps on relatively large scales, such as 1 : 20,000, 1 : 10,000, 1 : 1,000 and larger, and maps on relatively small scales, such as 1 : 50,000, 1 : 100,000, 1 : 200,000 and smaller. Upon maps of the former class, most often prepared as a basis for drainage, irrigation and other engineering works, the surface of the land is rendered feature for feature, down to the merest minutiae and the contour lines are frequently run out individually by instrumental survey. "Eye-sketching" plays but an insignificant part in the make-up of such maps, and their main asset lies in their quantitative accuracy. For this reason they are designated "topometric maps" and the art of making them is styled "topometry."

Maps of the latter kind, on the other hand, by virtue of the limitations set by their scales can give only a generalized protrayal of the land. They are not replicas of the relief in miniature—rather, they partake of the nature of abstracts or condensed statements serving to bring out essentials, at the sacrifice, purposely, of irrelevant detail. Such maps are properly termed "topographic," and the art of making them is called "topography."

That the two classes of maps grade into each other is evident, at the same time there is great value in drawing the distinction. For, while the preparing of topometric maps involves only surveying and skilled drafting, the preparing of topographic maps is a complicated and subtle art, requiring besides skill in surveying and drafting, trained judgment in the condensing of topographic facts and in their intelligent portrayal in generalized form. Topographic mapping is essentially interpretative and synthetic in its nature, and for its best results demands from the topographic delineator insight into the significance of land forms as well as schooling in the principles of topographic "abstracting." This is a fact that appears to be as yet little appreciated by the geographers, topographers and engineers of this country. In France the desirability of the topographer having an intelligent understanding of the land forms with which he deals has long been recognized, and the analytical study of those land forms (detail forms mostly) has become known by the name "topology." A two-volume work entitled *Topologie*, by General Berthaut, Chief of the Service Topographique de l'Armée, recently published, has served to formally usher in the new science. It is to be hoped that some day a similar work may appear in this country for the guidance of American topographers, and if so, that it may go one step further than Berthaut's treatise and undertake to lay down the cardinal

principles that should underlie all condensing and generalizing of topographic facts on reduced scales. Until these principles are formulated and have become a fundamental part of every topographer's equipment, the signal lack of uniformity in topographic portrayal that characterizes our maps today must continue to prevail, and the topographer's art will not be able to lay claim to that economy of high grade production which only a scientific foundation can secure. F. E. M.

ZOOLOGY.—*A review of the cephalopods of western North America.* S. STILLMAN BERRY. Bulletin of the U. S. Bureau of Fisheries, vol. 30, 1910, p. 267–336, pls. xxxii–lvi. Issued July 24, 1912.

The purpose of this paper is not to present a monograph, nor even a complete catalogue of the species now living within the area indicated, but, as stated by its author, is rather

to bring out of chaos and present under one cover a résumé of such work as has already been done, making the necessary corrections wherever possible, and adding accounts of such novelties as have been brought to my notice.

Descriptions are given of all the species known to occur or reported within our limits, and these have been made as full and accurate as the facilities available to me would allow. I have hoped to do this in such a way that students, particularly in the Western States, will find it unnecessary to have continual access to the widely scattered and often unavailable literature on the subject. In a number of cases, however, the attitude adopted must be understood as little more than provisional in its nature, and more or less extensive revision is to be expected later, especially in the case of the large and difficult genus *Polypus*, which here attains a development scarcely to be surpassed anywhere.

In dealing with genera or higher groups I have nowhere endeavored to give complete diagnoses, but mention is made of such of their more salient characteristics as may serve for at least their temporary recognition by the student unfamiliar with cephalopods.

The material upon which the paper is based consists of some 600 specimens, contained in collections of the U. S. Fisheries Steamer *Albatross* in Alaska and off the California coast; miscellaneous series in collections at Stanford University; a small collection possessed by the department of zoology of the University of California, and a small series of octopods received from the Marine Biological Laboratory at La Jolla, California, besides the private collection of the writer. The region covered embraces the western shores of North America between Bering Strait on the north and the Coronado Islands on the south, together with the immediately adjacent waters of Bering Sea and the North Pacific

Ocean. Twenty-two species of cephalopods are represented, among them a fair number of novel forms,

the interest of which, however, is mainly zoogeographical and as a rule throwing little light upon the broader problems of morphology and interrelationship.

To the paper is appended a bibliography of 137 titles, with reprints of several of the earlier and more inaccessible papers having a direct bearing on the teuthology of the west American region and containing the original descriptions of several species. ETHEL M. SMITH.

ZOOLOGY.—*Some hydroids of Beaufort, North Carolina.* C. MCLEAN FRASER. Bulletin of the U. S. Bureau of Fisheries, vol. 30, 1910, pp. 337–388, 52 text figures. Issued July 23, 1912.

Altho Beaufort had not been expected to yield large collections of hydroids, two weeks devoted to the purpose by Dr. Fraser in August and September, 1911, with facilities of the U. S. Fisheries Laboratory at his disposal, produced material of much interest and surprising abundance for so limited a period. The sources were the piles and rocks at low water, floating gulfweed, and dredgings, chiefly in Bogue Sound and, by the U. S. Fisheries Steamer *Fish Hawk*, some 23 miles outside the harbor.

Of the 51 species obtained but one is new, though several are new to this part of the coast and four gonosome descriptions are new. Much of the material was in such good condition and contained so many good specimens, that many interesting points were made out and it was possible to add much new matter to the regular descriptions of species.

The locality is of very great interest because it is less than 100 miles from Cape Hatteras, which has been considered somewhat of a rival of Cape Cod as a divisional point for different groups of marine forms. A study of the distribution of even the few species collected is illuminating, and, altho what may be true of hydroids is not necessarily true of other forms and in some cases might seem to be necessarily untrue of them, the comparisons afforded warrant some generalizations.

In the first place, when 31 species out of a total of 51 have been reported from the east coast of North America farther north, there is no evidence, so far as hydroids are concerned, that Cape Hatteras with its storms is any decisive barrier. In the second place, what little evidence there is on this question goes to sustain the conclusion that many of the hydroids have been distributed from a circumpolar area, southward

along meridional lines. When out of 51 species collected as far southward as Beaufort there are included as many as 12 species that have been found on the west coast of Europe and also on the west coast of North America, it seems scarcely possible to come to any other conclusion. In the third place, there is further evidence of the relationship of the hydroid fauna of Beaufort and the Bermudas, 9 out of the 11 species common to both localities being forms that would likely be carried on the sargussum with the Gulf Stream. Finally, there is added evidence, if such be needed, that there is no limit to the distribution of hydroid forms, Beaufort, in low latitude, being connected by hydroid distribution with such distant places as Australia, Chile, Bering Sea, and the White Sea, all in high latitudes, and having not one but several species in common with Beaufort. ETHEL M. SMITH.

BOTANY.—*The North American species of Nymphaea.* GERRIT S. MILLER, JR. and PAUL C. STANDLEY. Contribution U. S. National Herbarium, **16**: 63–108, pls. **35–47**, figs. **2–40.** 1912.

This is a monograph of the species of Nymphaea, the yellow-flowered pond lilies, of North America. Heretofore about half a dozen forms have been recognized within this area, but the number is here increased to 19, of which 10 are described as new. The study was based principally upon a large series of fresh specimens, obtained during a period of several years, but in addition the herbarium material of all the larger collections was examined. The genus has a wide distribution in North America, occurring in all of the divisions of the United States except two, and ranging north to Alaska, and as far south as Mexico and Cuba. Most of the new species are from the region bordering the Gulf of Mexico, but one is from the Ozark plateau of Missouri and Arkansas, and one from the coastal plain of New Jersey. All the species are illustrated with half-tones or line drawings, or both. P. C. S.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

GEOLOGICAL SOCIETY OF WASHINGTON

The 258th meeting was held May 8, 1912, President Stanton in the chair. The following informal communication was presented: *The General Custer Vein in Idaho*, J. B. UMPLEBY.

REGULAR PROGRAM

Some phases of Philippine geology (illustrated by lantern slides): WARREN D. SMITH, Chief of Division of Mines, Philippine Islands. For our present knowledge of the geology of the Philippine Islands we are indebted chiefly to four men—Abella, former chief of the Spanish Mining Bureau; Becker, first American geologist to visit the islands; McCaskey, the second chief of the American Mining Bureau, and Iddings, who has worked on Philippine rocks and who visited the islands in 1910. The igneous rocks are mainly diorite, representing the plutonic type, and pyroxene andesite the extrusive type. Leucite-bearing rocks have been found in one locality, Masbate, but this is an unusual development. Metamorphic rocks are represented by schists and gneisses, which are probably metamorphosed sedimentary and igneous formations of Tertiary or Mesozoic age. Of the sedimentary rocks there are none that we know positively to be older than Eocene. Most of the sediments are Miocene and later. Coral and orbitoidal limestones are wide-spread. Some red cherts containing uncertain fragments of sponges and radiolaria, and possibly to be correlated with similar material of Jurassic age in the Moluccas have been found in northern Luzon.

Coal, oil, iron, gold and copper are the principal economic deposits of the islands. Coal of a sub-bituminous grade, in which the fixed carbon is usually less than 50 per cent, is widespread. One seam 1½ feet thick having 82 per cent of fixed carbon has been found in Mindanao. What appear to be large deposits of bessemer iron ore exist in Luzon, and pig iron is being produced by crude processes by the natives. A long-known and fairly good deposit of copper ore (largely enargite) occurs in northern Luzon, but fuel and transportation difficulties delay development. A deposit of the native metal exists in Masbate, but this is also undeveloped. There are several stamp mills and gold dredges operating now in the islands and the industry has a bright future. Oil seepages to the number of at least half a dozen have been found on Cebu, Leyte, and Tayabas Peninsula, some of the oil being paraffin oil of light gravity. The possibility of the existence of commercial quantities has not been tested.

Problems of oil and gas accumulations in the Appalachian Region: M. J. MUNN. The oil and gas fields generally included within the Appalachian region are situated in southern New York and the western parts of Pennsylvania and West Virginia, the eastern parts of Ohio and Kentueky, middle Tennessee, and northern and western Alabama.

Structurally this part of the region is a broad flat geosyncline, roughly coincident with the Appalachian Plateau. The deepest part of this great structural basin is in the western part of West Virginia about 10 miles southwest of the corner of Pennsylvania. The general dip of the rocks toward the center of this basin is broken by a series of minor, open, irregular folds most of which trend northeast-southwest. The pitch of the axis of this trough has not been determined thruout its length but from the vicinity of Pittsburg southward to the center of the basin, a distance of about 125 miles, it is approximately 2400 feet. At the center of the basin the rocks consist of probably about 5000 feet of Devonian sandstone and shale and thin beds of limestone, overlain by about 3000 feet of Carboniferous rocks of Mississippian, Pennsylvanian, and Permian series, consisting of shale, sandstone, limestone, clay, and—in the Pennsylvanian and Permian—many coal beds. The Permian rocks are exposed over several hundred square miles in the center of the basin and successively older formations outcrop in going from the axis of the fold both east and west.

The special points brought out in this paper were as follows: (1) By far the largest number of oil and gas pools and also the largest pools are grouped along the axis of this geosyncline, in areas where the rocks have dips of less than 200 feet to the mile and rarely more than 75 feet to the mile. (2) On the west side of the axis of this geosyncline oil pools predominate, though a number of large gas fields occur. East of this axis only a few small oil fields have been found; this part of the region containing many of the greatest gas fields yet discovered, in areas where the rocks have in general a somewhat greater dip than in the oil fields on the west side of the axis. (3) The oil and gas pools which occur near the outer edges of this productive region farthest from the center of the basin are found at relatively shallow depths in sandstones which show considerable quantities of salt water closely associated with the oil. When these sandstones are traced toward the center of the basin the volume of salt water appears to increase in each sandstone up to a certain distance from the outcrop and depth from the surface. Beyond this, down the dip of the beds, and therefore at greater depths from the surface, the amount of salt water decreases, until, at the center of the basin many of the sandstones that furnish salt water somewhere up the slopes are found to contain no water when penetrated by the drill. (4) Many large gas fields in flat-lying rocks near this axis show little or no water in the producing sand in and immediately surrounding the gas field, the sand being continuous over large areas and the closed pressure of the gas ranging up to over 1000 pounds per square inch.

One of the objects of the paper was to show that the general regional conditions accompanying the occurrence of oil and gas in these fields

is such as to discourage the idea that accumulation has been accomplished solely through difference in gravity of oil, gas and water inclosed in a porous bed.

The last meeting for the spring, the 259th, was held May 22, President Stanton presiding. The following informal communications were given:

E. G. WOODRUFF on *A bituminous black shale in the Debeque Quadrangle, Colorado;* L. C. GRATON on *Primary chalcocite ore from British Columbia;* and F. L. HESS on *A new roscoelite vein near Placerville, Colorado.*

REGULAR PROGRAM

Structure of the foothills of the Front Range, Central Colorado: G. B. RICHARDSON. The speaker directed attention to a series of strike faults. which heretofore have escaped notice, in the foothills in the Castle Rock quadrangle, Colorado. Stratigraphic evidence of the dislocations is concealed for long distances by outwash deposits, but locally there is proof of profound faulting parallel to the general trend of the Front Range. Six miles south of Palmer Lake, at the base of the mountains just north of Deadmans Creek, a narrow belt of strata of Colorado age standing on edge lies between low-dipping beds of the Fountain formation (Pennsylvanian) on the west and perpendicular Dawson arkose (Eocene) on the east. These relations are due to parallel faults striking north and south. The major portion of Perry Park, 10 miles southeast of Castle Rock, is included between two parallel curved faults. At the eastern end of the park a fault causes the formations from the Fountain to the Colorado inclusive to strike into and abut against the Pierre shale. On the eastern side of the fault the Pierre strikes north and south and is almost vertical; on the western side the strike is northwesterly with dips ranging from 10 to 45 degrees.

Along the western boundary of the Perry Park block another fault, in general parallel to that just outlined, causes the Fountain formation, dipping 10 to 15 degrees northward, to abut against the Pikes Peak granite in the southern part of the Park, while farther north this fault cuts across the Fountain and forms the boundary between that formation and the Lyons(?) sandstone, the former dipping at an angle of about 15 degrees and the latter standing almost vertical. At the northwestern end of Perry Park, the westward continuation of the zone of faulting just described (actual tracing being prevented by a cover of Quaternary wash) apparently causes strata of the Colorado group to lie in close proximity to the Lykins formation (Permian?). These relations heretofore have been considered due to erosional unconformity developed on the so-called Castle "arch."[1] The question was raised whether similar relations at the Golden and Boulder "arches," which in the Denver Monograph are accounted for by unconformities, may not have been caused by a series of longitudinal faults.

[1]Lee, W. T., Areal Geology of the Castle Rock region, Colorado: American Geologist **29**: 96–109. 1902.

The Front Range, at least in the Castle Rock region, is not a simple monoclinal uplift, but strike faulting along the base of the mountains has played a more important part than has been supposed.

The Lewis overthrust, Glacier National Park: M. R. CAMPBELL.

The Bannock overthrust, southeast Idaho: R. W. RICHARDS.

ROBERT ANDERSON,
R. W. RICHARDS,
Secretaries.

THE BOTANICAL SOCIETY OF WASHINGTON

A special meeting of the Society was held September 18, 1912, in honor of Prof. Hugo De Vries, of Amsterdam.

Professor De Vries spoke on *The future of plant breeding as related to agricultural production.* The speaker advanced a modified view of the Malthusian doctrine and emphasized the necessity for developing means whereby the productiveness of food plants can be greatly increased, and the desirability of producing new forms of plant life which may be utilized as a source of food materials. This is necessary if the increase in food production is to keep pace with the increase in population. Up to the present time this has been possible but unless some means is found of obtaining a greater yield than is possible today, future generations must face the problem of an insufficient food supply.

We are rapidly approaching the limits beyond which the further combination and selection of our best strains of plants will give no increased advantage. There is need of securing entirely new forms of plant life and experimental plant breeding is now laying a firm foundation for the production of such new forms. As this work is extended it will be necessary to study the various forms of plant life in order to discern the natural course through which the better strains have come into existence; then by following this course under experimentally controlled conditions it may be possible to produce new forms which will far exceed in productiveness those with which we are familiar at the present time.

At the close of the address brief appreciative talks were made by W. M. Hays, E. F. Smith, W. J. Spillman and F. V. Coville, on various aspects of Professor De Vries' work as a scientist.

W. W. STOCKBERGER, *Corresponding Secretary.*